

Homework 2

1 Model Checker

1.1 Satisfy

1.1.1 Recursion

The model checker in B&B uses the Prolog predicate *satisfy* in order to evaluate whether a given proposition is true or false. Explain how and why recursion is used in the code shown below.

```
/*=====
Conjunction
=====*/

satisfy(and(Formula1,Formula2),Model,G,pos):-
    satisfy(Formula1,Model,G,pos),
    satisfy(Formula2,Model,G,pos).

satisfy(and(Formula1,Formula2),Model,G,neg):-
    satisfy(Formula1,Model,G,neg);
    satisfy(Formula2,Model,G,neg).
```

1.1.2 Alternative Formulations

We are again concerned with the *satisfy* predicate. In two cases, namely for *if-then* and *all*, the code as it is written in the model checker chooses to pursue an indirect route. Instead of defining the truth conditions directly, the code uses a logical equivalent (see below). In this exercise, we ask you to define the truth conditions of the formulas with *if-then* or *all* directly. (If you redefine both, you will receive extra points.)

```

/*=====
   Implication
=====*/

satisfy(imp(Formula1,Formula2),Model,G,Pol):-
    satisfy(or(not(Formula1),Formula2),Model,G,Pol).

/*=====
   Universal Quantification
=====*/

satisfy(all(X,Formula),Model,G,Pol):-
    satisfy(not(some(X,not(Formula))),Model,G,Pol).

```

1.2 Formulas in Prolog

Formulate the following example sentences so that one can use them as input for the model checker via the *satisfy* predicate. Try out your results with respect to Model 3 by means of the *evaluate* predicate. Try out the sentences with `modelchecker1.pl` as well as `modelchecker2.pl`.

- (1) a. Jody is (a) man or woman.
 $\text{MAN}(j) \vee \text{WOMAN}(j)$

- b. Mia is (a) woman and (a) customer.
 $\text{WOMAN}(m) \wedge \text{CUSTOMER}(m)$

- c. Mia or Jules tells a joke.
 $\exists x [\text{JOKE}(x) \wedge (\text{TELL}(m,x) \vee \text{TELL}(u,x))]$

- d. In all episodes there is a joke.
 $\forall x [\text{EPISODE}(x) \Rightarrow \exists y [\text{JOKE}(y) \wedge \text{IN}(y,x)]]$

2 DCGs

In this exercise you practice with DCGs.

2.1 Agreement

Do exercise 8.1 in BB&S (pp. 155–156).

2.2 Small Grammar

Write a Prolog program that contains a DCG for the sentences in (2).

- (2) a. Vincent loves Mia.
b. She owns a fast car.
c. He loves fast red cars.
d. Every woman loves a boxer.
e. Every boxer snores.

2.3 Parsing

Modify the DCG so that a parse tree is also provided.